

### 3. Esteban

**Program Name:** Esteban.java

**Input File:** esteban.dat

Esteban hates hot humid weather! He has visited many places across Texas and observed the western and northern areas of Texas seeming cooler than the central and eastern areas even though actual reported temperatures may be about the same or even higher. He found a heat index formula on the web but it is way too complex to use a calculator for multiple samples. He also found formulas to convert between °F and °C, because his grandparents live in Spain, which he visits every summer, and they report temperatures in Celsius. The heat index (**HI**) formula shown below uses ambient (dry shade) air temperature in °F (**t**) and relative humidity % (**h**) to produce a heat index, often reported as the “feels like” temperature.

$$\begin{aligned} \text{HI} = & -42.379 + 2.04901523t + 10.14333127h - 0.22475541th \\ & - 6.83783 \cdot 10^{-3}t^2 - 5.481717 \cdot 10^{-2}h^2 + 1.22874 \cdot 10^{-3}t^2h \\ & + 8.5282 \cdot 10^{-4}th^2 - 1.99 \cdot 10^{-6}t^2h^2 \end{aligned}$$

$$C = \frac{5}{9}(F - 32) \quad \text{and} \quad F = \frac{9}{5}C + 32$$

However, there are limitations with the **HI** formula. To start with, the formula is valid only when temperature is at or above 80 °F and there are two situations that require an adjustment to the calculated heat index:

1. When humidity is less than 13%, the following adjustment is subtracted from **HI**:  

$$\text{ADJUSTMENT} = ((13 - h) / 4) * \text{SQRT}((17 - \text{ABS}(t - 95.0)) / 17)$$
 where ABS and SQRT are absolute value and square root functions, respectively.
2. When humidity is greater than 85%, the following adjustment is added to **HI**:  

$$\text{ADJUSTMENT} = ((h - 85) / 10) * ((87 - t) / 5)$$

In addition, there are two situations when the above formulas produce invalid results:

1. When the calculated heat index is over 140 °F
2. When the calculated heat index is below ambient air temperature (°F) with humidity at or above 40%

**Input:** First line contains a single whole number,  $N \leq 50$ , number of test cases that follow. Each test case consists of a single line with whitespace separated values: either ‘F’ or ‘C’ to indicate which temperature is provided, ambient air temperature, and relative humidity. Both numeric inputs will be whole numbers with  $0 \leq \text{temp} \leq 150$  and  $0 \leq \text{humidity} \leq 100$ .

**Output:** The case # followed by a colon and the heat index with 1 digit following the decimal point, matching the input temperature type with either ‘F’ or ‘C’ as shown below. When the calculated heat index is invalid, add a space and “INVALID” to the output line.

**Sample input:**

```
7
F 97 44
C 42 47
F 79 12
C 26 52
F 90 11
F 80 40
C 35 86
```

**Sample output:**

```
#1:105.6F
#2:59.1C
#3:77.5F INVALID
#4:26.6C INVALID
#5:85.5F
#6:79.9F INVALID
#7:60.6C INVALID
```